

REMARKS

Reconsideration of the above-identified patent application in view of the remarks following is respectfully requested. Claims 1-29 are pending in the application. Claims 16-29 have been withdrawn. Claim 1-15 are rejected. The rejection of claims 1-15 is respectfully traversed. However, in order to further distinguish the invention over prior art and to expedite allowance, Applicant hereby cancels claims 10 and 15 and amends claim 11 to incorporate the limitations of claim 10, making claim 11 an independent claim.

The above-mentioned patent application discloses dynamic bandwidth allocation and queue management methods and algorithms in an Ethernet passive optical network (EPON). The methods are designed to avoid fragmentation loss and guarantee that a length of a grant issued by an OLT will match precisely the count of bytes to be transmitted by an ONU. The methods include determining an ONU uplink transmission egress order based on a three-stage test, and provide various embodiments for ONU report threshold setting. Fragmentation is eliminated while prioritization of a queue is kept.

Specification Objections

The specification was objected to for informalities: the description of FIG. 5 did not match to what was depicted in the figure. Applicant has replaced the original FIG. 5 with a replacement drawing that now matches the description. No new matter has been added, as the drawing follows closely and includes only the material originally in the description.

Claim Objections

Claims 7-9 and 14-15 were objected to because of informalities. A proper dependency is hereby inserted in claim 7 and claim 14 is hereby amended as suggested by the Examiner. Claim 15 is cancelled.

§ 102 Rejections

Claim 1 was rejected under 35 U.S.C, 102(e) as being anticipated by Kramer et al (US 6,546,014), hereinafter "Kramer". The rejection is respectfully traversed.

Kramer discloses (Abstract) an optical access network and method for transmitting optical data in the network utilizes an interleaved polling scheme to efficiently use the available bandwidth of the network. The use of the interleaved polling scheme allows a central terminal of the network to dynamically allocate upstream bandwidth from remote terminals of the network to the central terminal in response to the amount of data that is waiting at the remote terminals to be transmitted to the OLT. The allocation of upstream bandwidth is on an as needed basis, so loss of bandwidth due to unfilled time slots is substantially eliminated.

Kramer's disclosure does not deal with fragmentation loss at all, and therefore does not propose a solution to avoid it. In fact, "fragmentation" is mentioned only once, in the paragraph cited by Examiner (col. 9, lines 21-39). *Mutatis mutandis*, Kramer does not disclose a method for transmitting packets by an optical network unit (ONU) comprising the steps of: receiving a grant having a grant length from an optical line terminal (OLT) of the PON; and, based on said grant, calculating an ONU packet egress order that eliminates packet fragmentation. Kramer does not calculate a packet egress order that eliminates packet fragmentation or any equivalent thereof. The sentence: "*For example, if one or more higher-priority data packets arrive at an ONU after a Request message is sent, the ONU may send the higher-priority data packets before the other buffered data*", cited by Examiner indicates (in Kramer's own words) a problem, not a solution to fragmentation loss. Therefore, lacking a key feature recited therein, Kramer cannot and does not anticipate Claim 1. Moreover, Kramer does not even render claim 1 unpatentable.

§ 103 Rejections

Claims 2-9 were rejected under 35 U.S.C, 103(a) as being unpatentable over Kramer et al (US 6,546,014), in view of Shi et al (US 2003/0179769), hereinafter "Shi". The rejection is respectfully traversed. Applicant notes that in the body of the

rejection, the Shi reference appears to be applied only to claims 2, 3 and 9, claims 4-8 being apparently rejected as being unpatentable only over Kramer.

Shi discloses allocation of upstream bandwidth in an EPON through use of a superframe having a number of subframes arranged in a two-dimensional array, wherein for normal data transfer subframes are allocated to each ONU column by column, left to right, and within each column subframes are allocated from top to the bottom. The only reference to fragmentation (except for an irrelevant mention in the Background) is in paragraph 0020:

Each superframe may be viewed as having a number of frames, with each frame having a number of subframes that form a row of a two-dimensional array, wherein the optical line terminal (OLT) receives the superframe one frame (i.e. one row) after another. In some embodiments, subframes in each superframe are allocated to an optical network unit (ONU) column by column, left to right, and within each column subframes are allocated from top to bottom. Such a systematic allocation of non-adjacent subframes to an optical network unit (ONU) avoids fragmentation of the superframe if a reverse procedure is followed for deallocation (e.g. if deallocation is also done column by column from right to left, and within each column from bottom to top)

The term "superframe" is not an EPON standard term, columns are not mentioned in the EPON standard, and "systematic allocation of non-adjacent subframes" is an OLT, not ONU feature. Clearly, Shi (like Kramer) does not perform "calculating an ONU packet egress order that eliminates packet fragmentation", a key feature recited in claims 2-9. There is nothing in Shi that deals with an ONU packet egress order at all. Therefore, the combination of Kramer and Shi fails a *prima facie* test for obviousness, because neither reference teaches a key limitation of the invention claimed in these claims and because the combination of the two references does not teach all of the limitations of any of the claims. Consequently, Kramer in view of Shi cannot and does not render claims 2-9 unpatentable. Specifically:

Claim 2: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. *Mutatis mutandis*, neither reference teaches wherein in claim 1 the step of calculating is preceded by a step of handling out of band information, and includes handling a sub-queue of a given priority.

Claim 3: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. *Mutatis mutandis*, neither reference teaches wherein the handling in claim 2 includes checking the sub-queue for

ungranted packets, and wherein the step of calculating includes performing a three stage test on each of the ungranted packets, each of the stage tests involving a stage variable.

Claim 4: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. *Mutatis mutandis*, neither reference teaches wherein the stage variable in claim 3 is selected from the group consisting of reported bytes below threshold, reported total bytes, and total bytes, and wherein the performing of a stage test involving a stage variable includes comparing a value of the stage variable to zero.

Claim 5: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. *Mutatis mutandis*, neither reference teaches wherein in claim 4 the ungranted packet is marked as granted, if the result of the comparison is that the value of the stage variable is greater than zero.

Claim 6: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. *Mutatis mutandis*, neither reference teaches wherein the grant is a flexible grant set by the OLT based on information received from the ONU.

Claim 7: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. There is no notion of threshold in Kramer at all. *Mutatis mutandis*, neither reference teaches wherein in claim 6 the information includes a combination of values of bytes below threshold and total bytes.

Claim 8: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. There is no notion of threshold in Kramer at all. *Mutatis mutandis*, neither reference teaches wherein in claim 7 the threshold is adaptive.

Claim 9: Neither Kramer nor Shi teach a step of calculating an ONU packet egress order that eliminates packet fragmentation. There is no notion of threshold in Kramer at all. *Mutatis mutandis*, neither reference teaches wherein in claim 7 the values of bytes below threshold and total bytes are accumulated from highest to lowest priority.

Claims 10-12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kramer et al (US 6,546,014), in view of Shi et al (US 2003/0179769). The rejection is respectfully traversed.

Claim 10 is hereby cancelled, rendering its rejection moot. Claim 11 is amended to incorporate all of the limitations of claim 10.

Amended claim 11 now recites a method for eliminating packet fragmentation comprising the steps of: (a) providing an optical line terminal (OLT) connected to a plurality of optical network units (ONUs), each of the ONUs transmitting packets arranged in sub-queues having a total byte length, the packets transmitted in response to a grant received from the OLT, the grant having a grant length; and (b) matching said total byte length with said grant length, wherein said step of matching includes, by each said ONU, hiding from said OLT an update in a queue status, whereby the fragmentation loss is eliminated. Neither Kramer nor Shi teach step (b), in particular the limitation of hiding from the OLT an update in a queue status. Therefore, the combination of Kramer and Shi fails a *prima facie* test for obviousness, because neither reference teaches a key limitation of the invention claimed in these claims and because the combination of the two references does not teach all of the limitations of any of these claims. Consequently, Kramer in view of Shi cannot and does not render claims 11-12 unpatentable.

Specifically in claim 12, neither Kramer nor Shi teach a step of matching said total byte length with said grant length, wherein said step of matching includes, by each said ONU, hiding from said OLT an update in a queue status, whereby the fragmentation loss is eliminated, wherein in claim 11 the hiding includes freezing a transmission order of queues.

Claims 13-15 were rejected under 35 U.S.C, 103(a) as being unpatentable over Kramer et al (US 6,546,014), in view of Shi et al (US 2003/0179769 as applied to claim 11, further in view of Wellen (US 2002/0075884). The rejection is respectfully traversed. Claim 15 is hereby cancelled, rendering its rejection moot.

Wellen does not disclose the key features recited in claim 11 of "matching said total byte length with said grant length, wherein said step of matching includes, by each said ONU, hiding from said OLT an update in a queue status, whereby the fragmentation loss is eliminated". Therefore, the combination of Kramer, Shi and Wellen fails a *prima facie* test for obviousness, because neither reference teaches a key limitation of the invention claimed in claims 13-14 and because the combination of the references does not teach all of the limitations of these claims. Consequently,

Kramer in view of Shi and further in view of Wellen cannot and does not render claims 13-14 unpatentable. Specifically:

Claim 13: Neither Kramer, nor Shi nor Wellen teach wherein in claim 10 the step of matching further includes checking, from highest to lowest priority each of the sub-queues, identifying in each sub-queue ungranted packets with respective ungranted packet lengths, and marking each the ungranted packet as about to be transmitted.

Claim 14: Neither Kramer, nor Shi nor Wellen teach wherein in claim 13 the marking includes comparing to zero a stage variable selected from the group of reported bytes below threshold, reported total bytes, and total bytes, and marking an ungranted packet as granted if the stage variable is greater than zero.

In view of the above amendments and remarks it is respectfully submitted that claims 1-9 and 11-14 are now in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,

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Date: April 14, 2008